

Claims 7 and 8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Respective recitations of "recommended in the manufacturer's specification", "lower than recommended by manufacturers..." and "their conventional design software" are all indefinite and ambiguous, it is suggested that claims 7 and 8 be amended to merely recite that the membranes are operated at selected pressurized feed and/or concentrate flow rates and ...adding...treated antiscalant and/or acid chemicals at a selected concentration", respectively.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out

the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1,7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wheatley et al patent 4,176,057 in view of Ilias et al patent 6,168,714 (newly cited) and the publication by Hasson et al from Desalination 139 Published 2001, entitled “Inception of CaSO₄ scaling on RO membranes at various water recovery levels”.

Wheatley discloses a process for purifying water containing a plurality of soluble species that tend to form a plurality of sparingly soluble salts and minerals (column 7, lines 40-50) including at least calcium carbonate (column 6, lines 20-23) pressurizing the water stream (column 5, lines 36-37), passing the stream into a treatment zone having membranes disposed therein so as to form permeate and concentrate or retentate streams that are controllably withdrawn (column 5, lines 27-48); and periodically reversing the direction of flow of the stream in the treatment zone during periodic membrane filter backwashing periods (column 8, lines 5-27). The reverse flow and backwashing is initiated when the feed stream becomes supersaturated such that the salts and minerals begin to precipitate onto the filter membrane surfaces, as detected by monitored differential pressures (column 7, lines 53-59). Wheatley also concerns minimizing of such supersaturation and precipitation by treating the feed stream with chemicals and additives (column 4, lines 52-65).

Claim 1 and claims dependent therefrom, differ from Wheatley by requiring estimation of "induction time" corresponding for time required for the water stream to become

supersaturated sufficiently to precipitate one or more of the salts and minerals, and setting the periodic flow reversal to take place prior to the induction time such that the membrane(s) are exposed to supersaturated conditions for less than the induction time. However, Ilias teaches to selectively and periodically reverse flow of a feed stream through a membrane filter(s) (Abstract) and to set the periodicity at intervals that mitigate effects of concentration polarization and membrane fouling by reversing flow at frequencies that prevent precipitation of solutes in the feed stream and consequent deposits formed on the membrane surfaces (column 2, line 62-column 3, line 3). The intervals for reversing flow consider concentrations of solutes and other substances in the feed stream and monitoring of feed and permeate flow rates indicative of the feed stream becoming supersaturated (column 5, lines 40-47 and column 6, lines 13-23).

Additionally, the Hasson et al publication explicitly teaches to estimate and compute the induction time for feed streams to become supersaturated and to optimize dosages of scaling or precipitation-preventing additives to the feed streams based on the calculated induction times (See in particular, Abstract and Section 3.3 'Induction time determination' and Sections 4.1 and 4.2). In summary, it would have been obvious to one of ordinary skill in the art to have modified the operation of the Wheatley process, by estimating and computing induction times associated with formation of supersaturation and conditions causing concentration polarization and precipitation of solutes onto membrane surfaces, and consequently setting frequency of the flow reversal to prevent such precipitation, as taught by Ilias and Hasson et al, and in order to maintain optimal flux through the membrane treatment zone, minimize down-times and extend the useful working life of the membrane filter(s).

For claim 8, the concentrations of anti-scalant chemicals added in Wheatley are low (column 4, lines 63-65).

For claim 7, Ilias teaches control or presetting of operating flow rates and system pressure (column 6, lines 16-23).

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wheatley et al patent 4,176,057 in view of Ilias et al patent 6,168,714 (newly cited) and the publication by Hasson et al from Desalination 139 Published 2001 as applied to claims 1,7 and 8 above, and further in view of Lauer patent 5,690,829, of record.

For claim 3, Wheatley also discloses the treatment zone as a pressurized vessel (column 5, lines 36-38), with openings communicating with feed pipe 33, permeate collecting tubes 40 and concentrate-collecting pipe 43 (column 5, lines 27-48). Ilias references “prior art” teaching of the direction of flow being augmented by alternating feeding of the feed stream between openings on opposite sides of the membrane filters (Abstract and column 4, lines 5-24), however advocating that flow reversal be effected by reversing withdrawal of permeate through different ports (column 4, lines 25-33, etc.). Lauer teaches periodic, flow reversal of the feed stream through a membrane filter being effected by direct alternating of feed stream flow between ports on opposite sides of the filter housing such that the opposite ports function alternately as inlet and outlet. It would have been further obvious to have utilized such arrangement for feeding of the feed stream flow, to have continuously effected constant change of pressure relationships on both sides of the membranes, so as to continuously remove the solute particles and encourage long operation and membrane lifetimes (Ilias at column 3, lines 25-34).

ALLOWABLE SUBJECT MATTER

Claims 2,4,5 and 9 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 2 distinguishes in view of recitation of the induction time being predetermined or estimated separately for each of the sparingly soluble salts and/or minerals present in the water stream. The prior art either concerns a single salt or all of salts & minerals present together in calculations for determining.

Claims 4 and 5 distinguish in view of recitation of “providing a two-way bypass valve for connecting 1st opening of the pressure vessel to the concentrate exit which is initially closed. The applied prior art for this and the previous Office Action teaches a variety of valving and pump arrangements but does not suggest such 2-way bypass valve component.

Claim 9 distinguishes in view of directing the withdrawn supersaturated concentrate into a precipitating crystallizer. A plurality of prior art concerns systems employing crystallizers combined with filters and membrane filtration units, including Jogand patent 6,036,867; Dyke patent 6,054,050 and Khamizov et al patent 5,814,224. Such prior art however generally concern different fluid streams directed to a crystallizer, such as the permeate stream from membrane units or process streams from pre-filtration units.

Claims 10-17 and 19-22 are similarly allowable for recitation of directing the withdrawn supersaturated concentrate into a precipitating crystallizer for precipitating one or more sparingly soluble salts and/or minerals.

Claim 1 would also distinguish if amended to include the first portions of claim 9 concerning “directing the withdrawn supersaturated concentrate into a precipitating crystallizer

for precipitating one or more sparingly soluble salts and/or minerals” . Claim 9 could then be amended to recite as follows: “...further comprising separation of solids from the liquid phase following crystallization and precipitation, and returning said liquid to the treatment zone”.

Applicant's arguments with respect to claim 1 and claims dependent therefrom have been considered but are moot in view of the new ground(s) of rejection, however are addressed to the extent they remain germane. In the paragraph bridging pages 2-3 of the Remarks, it is argued that noting in the prior art suggests that a reverse flow scheme in which the time between flow transitions is kept lower than the induction time may prevent precipitation fouling of the salts and minerals. However, Ilias, in contrast to Lauer, at least strongly suggests such control of the periodicity or frequency of flow through membrane filter, so as to prevent concentration polarization and sub-optimal filtration fluxes. Such teaching is supported by the text of the NPL Hasson et al publication.

Applicant's amendment, especially amendment of claim 1 to recite a discrete process step of estimating the induction time rather than reciting a property of periodicity of flow reversal relative to induction time, necessitated the new ground(s) of rejection, presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joseph Drodge at his direct government telephone number of 571-272-1140. The examiner can normally be reached on Monday-Friday from approximately 8:00 AM to 1:00PM and 2:30 PM to 5:30 PM.

Alternatively, to contact the examiner, send a communication via E-mail communication to the Examiner's Patent Office E-mail address: "Joseph.Drodge@uspto.gov". Such E-mail communication should be in accordance with provisions of MPEP (Manual of Patent Examination Procedures) section 502.03 & related MPEP sections. E-mail communication must begin with a statement authorizing the E-mail communication and acknowledging that such communication is not secure and will be made of record, under Patent Internet Usage Policy Article 5. A suggested format for such authorization is as follows: "Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with me concerning any subject matter of this application by electronic mail. I understand that a copy of these communications will be made of record in the application file.

Additionally, the examiner's supervisor, Nam Nguyen, of Technology Center Unit 1778, can be reached at 571-272-1342.

The formal facsimile phone number, for official, formal communications, for the examining group where this application is assigned is 571-273-8300. The facsimile phone number for informal communication directly with the examiner is 571-273-1140.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either private PAIR or Public PAIR, and through Private PAIR only for unpublished applications. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have any questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JWD
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/Joseph W. Drodge/
Primary Examiner, Art Unit 1778